NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY

SUBMARINE BASE, GROTON, CONN.

REPORT NUMBER 957

THE RELATIONSHIP OF VISUAL EVOKED POTENTIAL ASYMMETRIES
TO THE PERFORMANCE OF SONAR OPERATORS

by

Christine L. Schlichting and Scott W. Kindness

Released by:

W. C. MILROY, CAPT, MC, USN
COMMANDING OFFICER
Naval Submarine Medical Research Laboratory

11 August 1981

THE RELATIONSHIP OF VISUAL EVOKED POTENTIAL

ASYMMETRIES TO THE PERFORMANCE OF SONAR OPERATORS

by

Christine L. Schlichting, Ph.D.

and

Scott W. Kindness, HM3, USN

NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY
REPORT NUMBER 957

NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
Research Work Unit MR041.01.03-0155

Approved and Released by

W. C. MILROY, CAPT, MC, USN
Commanding Officer
Naval Submarine Medical Research Laboratory

SUMMARY PAGE

Problem:

 To determine whether the direction or magnitude of interhemispheric asymmetries in visual evoked potential amplitude is related to performance on visual sonar tasks.

Findings:

 For sonar operators as a group the right side of the brain shows greater amplitude in response to complex visual stimuli. This asymmetry is reduced in operators who receive low performance ratings from their supervisors.

Application:

 These results suggest that measures of visual evoked potential amplitude can be used to predict the performance of sonar operators. These measures could also be used to test the effect of different training methods on different watch schedules.

PUBLISHED BY THE NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY

ABSTRACT

Interhemispheric differences in visual evoked potential amplitude were measured in 32 right handed sonar operators. Each operator was also rated by his supervisor as to his performance using visual sonar displays. Significant interhemispheric asymmetries were found in the group as a whole and in the better performers. Poorer performers did not show asymmetries. These results suggest that the magnitude and direction of interhemispheric asymmetries in evoked potential amplitude can be used in the prediction of performance as sonar operators. These measures could also be used to test the effect of training and watch-standing schedules.

INTRODUCTION

One of the problems facing the United States Navy is the development of objective measures of on-the-job performance in such areas as fire control and sonar. It would be particularly cost effective if these measures could be used to determine which men should be trained for these particular jobs, i.e., which men have the greatest capability to perform adequately or perhaps in an outstanding manner on a particular task. An additional and equally important aspect is the potential to use these objective measures to suggest modifications in training or watch standing schedules that would improve performance.

Recent studies using electro-physiological recording techniques (electroencephalograms and evoked responses) have shown some promise of being able to differentiate performance differences using inter-hemispheric asymmetries in the electrical response of the brain. In the electroencephalogram, measures of the amount and frequency of activity in the alpha, beta, and theta bands have been used. In the transient evoked response a variety of components and more global features have been measured. The latter research is pertinent to this study.

Several studies of transient evoked potentials (EP) have investigated interhemispheric differences in EP amplitudes in various populations. In general these studies suggest that there is a specialization of the cerebral hemisphere for particular tasks and particular kinds of stimuli. This speciali-zation may show up as a larger amplitude of the EP recorded over the specialized hemisphere. [For a review of hemispheric specialization, performance, and related evoked potential research, see Begleiter, 1979.] Normal subjects, for example, show greater amplitude of certain visual EP measures when recorded for visual stimuli over the right side of the brain as opposed to the left side. This finding has been reported for flashes of light (Lewis & Rimland, 1980), and for letter and visuospatial stimulus (Ledlow, Swanson & Kinsbourne, 1978; Rugg & Beaumont, 1979; Vella, Butler & Glass, 1972). Conversely for word stimuli the evoked potential amplitude is larger over the left hemisphere when a task is used that requires language processing, or is propositional in nature (Matsumiya, 1976).

Evoked potential amplitude also appears to vary as a function of reading ability, general intelligence and performance. This measure, for example, has been investigated in good and poor readers. These studies have reported that a flattening of the evoked potential waveform or reduced amplitude occurs in disabled readers compared to normal readers (Connors, 1970; Preston, Guthrie & Childs, 1974). Lewis, Rimland and Callaway (1976) found that evoked potential amplitude correlated with successful completion of a remedial reading program. It has also been found that left-hemisphere amplitude is larger than right-hemisphere amplitude in normal readers when word stimuli are used (Preston, 1979).

In a study of the effect of intelligence, Rhodes, Dustman and Beck (1969) measured evoked potential amplitudes in bright children (I.Q. above 120) and dull children (I.Q. lower than 90). The stimulus used was a flash of light. Bright

1

children showed larger evoked potential amplitudes than dull children. The bright subjects also had right-hemisphere amplitudes that were larger than their left-hemisphere amplitudes. There were no asymmetries in the dull children. The interhemispheric asymmetry is reduced in normals by alcohol and is also absent in mongoloid persons (Bigum, Dustman, & Beck, 1970; Lewis, Dustman & Beck, 1970).

Performance differences have also been related to EP variability. Schizophrenic adults and patients with Korsakoff's Syndrome have shown higher evoked potential variability than typically found in normals (Callaway, Jones & Layne, 1965; Malerstein & Callaway, 1969). Additionally, in the schizophrenics the high variability is related to poor perceptual performance (Inderbitzen, Buchsbaum & Silverman, 1970). In normal adults increased variability is negatively correlated with verbal I.Q. and is further sensitive to task uncertainty and interstimulus interval (Callaway, 1975).

In a more specific Navy application, Lewis, Rimland and Callaway (1979) studied various measures of the visual evoked potential and found that amplitude asymmetry values were of use in predicting successful "on-the-job" performance in Navy recruits. Lewis and Rimland (1980) studied evoked potential measures and their relation to performance of Navy sonar trainees on a sonar simulator. These authors reported a large asymmetry at the occipital areas which favored the right hemisphere in the good performers and the left in the poorer performers. The stimulus used in this study was a flashed white light.

The above studies all suggest that evoked potential asymmetries and variability are related to performance. However, more work is needed because in the case of reading, intelligence, clinical patients, and sonar performance the stimuli used to elicit the evoked response measures are not obviously related to the type of performance being assessed. This study is, therefore, designed to clarify further the relationship of evoked potential asymmetries to the performance of trained sonar operators on visual sonar displays. It is an extension of the earlier work by Lewis and Rimland in that the current study uses three visual stimuli including one (texture) designed to simulate a visual sonar display. The only evoked potential measures reported by Lewis and Rimland were microvolts root mean square (µVRMS) values, variance of the evoked potentials, and latency of the first three positive zero crosses. The current study includes µVRMS and amplitude and latency measures of the principal components.

One final difference is that in contrast to the previous study, the subjects in this study were not trainees but had already served on board nuclear submarines as sonar operators. They could, therefore, be rated by their supervisors as to their performance during actual patrol conditions.

METHOD

Subjects: Volunteers were trained sonarmen stationed either on FBM submarines or as instructors at the Naval Submarine School Sonar Operational Trainers at the Naval Submarine Base, Groton, CT. Subjects ranged in age from 19 to 36 with a

mean of 25.6 years, their rates went from SN to STSC(SS). The total number of subjects was 32. All were right handed according to the Briggs and Nebes (1975) handedness questionnaire.

The Stimuli: Each stimulus target was photographically reproduced and subtended 5° horizontally and 3.6° vertically when placed 35.7 inches from the subject's eyes. The targets were illuminated by a Grass PS-2 photostimulator set at an intensity of 4; this produced an overall luminance of the targets during stimulation of approximately 5 cd/m^2. Each target was illuminated for 10 microseconds. The interstimulus interval varied randomly with a mean of 3 seconds.

The stimuli consisted of three targets:

1. a neutral grey of 50% reflectance

2. a texture pattern divided into four quadrants with a visually different texture in one of the quadrants (Santoro & Fender, 1976)

3. a pattern of black and white vertical stripes in which each stripe subtended 1 degree (.5 cpd) at the viewing distance.

Electroencephalographic Recordings: Grass gold electrodes were placed on scalp sites O_1 and O_2 and were referenced to C_z. A_1 served as the ground. All sites are according to the International 10-20 System (Jasper, 1958). Electrode impedance was maintained below 5 k ohm. The signal was amplified by Grass P511 preamplifiers. The gain in each channel was set at 50,000. Filter settings were .1 cps for the low frequency and .1 kc for high frequency. Preamplifiers were calibrated to provide equal output for a 5 Hz square wave and the preamplifiers used to record each brain side were reversed for every other subject.

Evoked Potential Analysis: The electroencephalogram was analyzed using a PDP 1140 computer using a software averaging program developed locally. The EEG for each of the two occipital sites was first digitized by an AR11 A-D converter. Fifty epochs of 512 msec each were averaged at each site for each stimulus target.

For each of these combinations the microvolts root mean square (μVRMS) amplitude was calculated. The μVRMS amplitude is obtained by determining the mean voltage for the averaged evoked potential. The deviations from the mean for each of the 512 msec points were squared. Finally the average of these squared deviations was obtained. The square root of this value is the μVRMS and represents the standard deviation of the entire waveform.

The same software routine that calculates the μVRMS also provided the amplitude (measured from zero baseline) and latency of each of the major components in the averaged waveform. For some of the measures an asymmetry ratio was calculated using the following formula:

$$Ratio = \frac{O_2 - O_1}{O_2 + O_1} \times 100$$

where O_2 is the appropriate amplitude measure for the right brain hemisphere and O_1 is the amplitude for the left. This ratio is used in laterality research to take into account different levels of performance or amplitude in different subjects. It is calculated for each subject

separately.

PROCEDURE

Each subject was first asked to answer several questions related to hand usage for various tasks (Briggs & Nebes, 1975). Questions included the presence of a family history of left handedness. Information was also obtained as to the dominant eye, preferred foot, hand position while writing, presence of any physiological handicaps and possible birth trauma.

Each subject participated in one experimental session. Order of presentation of the stimuli was the same for each subject: first the stripe, then the grey, and finally the texture target. It would have been impossible to counterbalance order of presentation of the targets within performance rated groups because the visual evoked responses (VERs) were obtained before the subjects were rated by their supervisors. Order of presentation was therefore kept constant for all subjects with the realization that possible habituation effects may affect the amplitude of the responses to the later targets. Previous research, however, (Schlichting et al, 1980) had shown no effect of order of presentation on the μVRMS for these stimuli.

After all of the available men stationed on a particular submarine or duty station had participated as subjects, their supervisor was asked to rate each man's competence with visual sonar displays. The rating scale went from "completely incompetent" to "most competent I have ever known" with nine categories in all. Even if all the sonarmen at a duty

station had not volunteered the supervisor was asked to rate all of the men from the station. The scores were normalized for each rater by calculating a Z score for each set of ratings using the formula:

$$Z = \frac{X - \bar{X}}{\sigma}$$

where X is the individual rating, $\bar{X}$ is the mean rating and σ is the standard deviation of the ratings for all men at a given duty station.

RESULTS

The averaged evoked potentials obtained in this study were generally of a simple form with two major components. The label N_1 has been given to the first of these. This component reflects negative activity with a latency of 74 msec. P_1 is the other major component with a latency of approximately 142 msec. It is positive in polarity. Figure 1 shows an example of a texture waveform with these components marked.

N_1P_1

A peak to trough amplitude measure from N_1 to P_1 represents the maximum amplitude excursion in the evoked potential. Figure 2 presents the results of this amplitude measurement for each pattern type and each brain side.

An ANOVA of this amplitude measure showed that there was not a significant difference between the two sides of the brain [$F (1,31) = 1.68$] across the three stimuli. The pattern effect [$F (2,62) = 21.962$] and the interaction of brain side and pattern [$F (2,62) = 6.12$] were, however, both significant. This latter interaction is due to the fact that only the texture pattern shows

4

a sizeable difference in amplitude between the two brain sides (t = 3.13, df=32) although the stripe pattern shows a similar but smaller trend. Mean asymmetry ratios calculated for each of the stimuli were 5.19 for the texture, -0.74 for the grey, and 0.85 for the stripe. The three stimuli are significantly different from each other on a Newman Keuls test. The first stimulus (striped) presented had the largest amplitude, the second stimulus (grey) had the intermediate amplitude and the third stimulus (texture) had the smallest amplitude.

For the two individual components (N_1 and P_1) the effect of pattern type was significant for both while the brain side by pattern type interaction was significant only for the N_1 component.

μVRMS

Table I shows the μVRMS measure for each brain hemisphere and each stimulus. For the μVRMS measure the amplitude in the right hemisphere is significantly larger than in the left hemisphere for both the texture and the stripe stimuli. There is no difference for the grey stimulus.

In an ANOVA of these data the effect of brain side and pattern type were significant [Brain side $F_{(1,32)}$= 5.03, Pattern type $F_{(2,64)}$= 19.11].

Latency

The latency of the N_1 and P_1 components is shown in Table II. For both components the differences among the three stimuli were stat-

istically significant. This was due to a longer latency to the grey stimulus than to either of the patterned stimuli. There were no differences between the two sides of the brain and the interaction of brain side and stimulus type was also not significant.

Relationship of EP Amplitude and Supervisor Rating

The amplitude of the μVRMS and N_1P_1 measures were compared for the eight subjects who received the lowest supervisor rating and the eight with the highest. Figures 3 and 4 show the amplitude for these two measures for each of the groups and patterns. There were no significant asymmetries on the μVRMS measure for either group. On the N_1P_1 measure only the highest rated individuals showed interhemispheric asymmetries in amplitude. As with the group as a whole this amplitude measure showed significantly greater amplitude in the right hemisphere (t = 2.38, df=7) for the texture task only.

As can be seen from Figure 4, the magnitude of the N_1P_1 asymmetry shown by the highest rated group for the texture is several times greater than that shown by the lowest rated groups. This is true despite the fact that the overall amplitude tends to be higher for the lowest rated group. It is not true for the μVRMS measure.

A final related finding was a significant correlation for the N_1 component on the texture stimulus of the asymmetry ratio with supervisor rating [r = .40, df=31, p <.05] Those subjects showing the largest asymmetries received the highest supervisor ratings. This difference is not related to the age of the men:

there is no correlation between age and supervisor rating (r = .10, df=31).

Relation of EP Asymmetry and Family History of Left Handedness

In general the subjects who had a family history of sinistrality (n=12) showed comparable results to the subjects who had no left-handed relatives in the immediate family (n=20). There were, however, some notable differences, particularly in the magnitude of the differences. Figure 5 shows the μVRMS amplitude measure for these two groups for each of the three stimuli. On this measure only the subjects without left-handed relatives show a significant asymmetry, and this was on the texture stimulus (t = 2.97, df=19 p = .008). The direction of difference for the striped stimulus is the same but is not significant (t = 1.11 df=19). The group with left-handed relatives also has a small but not significant asymmetry on both the texture (t =1.78, df=11) and the striped stimuli (t =1.928, df=11).

Figure 6 shows the effect of a family history of sinistrality on the amplitude of the N_1P_1 component. For this measure of the maximum amplitude excursion it can be seen there is a significant difference between the two sides of the brain for the texture patterns for the subjects without a family history of left handedness (t =2.68, df = 19, p=.016) but the difference is reduced and not significant for the subjects with left-handed relatives (t = 1.62, df=11).

In addition, when the asymmetry ratios for N_1P_1 amplitude on the texture task are calculated for the individuals in each of the two groups, the subjects without left-handed relatives show interhemispheric ratios almost twice as large (mean ratio = 6.15) as the subjects with left-handed relatives (mean ratio = 3.594). This difference was statistically significant (t = 4.69, df=30, p <.001).

DISCUSSION

In keeping with several investigators (Rugg & Beaumont, 1979; Ledlow, Swanson, & Kinsbourne, 1975; Matsumiya, 1976; Vella, Butler, & Glass, 1972) this study found significant interhemispheric asymmetries for a complex visual stimulus for μVRMS and N_1P_1 amplitude. The latter component of the waveform has been noted by several investigators as being sensitive to pattern and texture effects (Jackson & Barber, 1980; Kinney, 1977). There were no asymmetries for a grey or a striped stimulus on the N_1P_1 measure. For a μVRMS measure both the striped and the textured targets showed interhemispheric asymmetries. It is most likely that the asymmetries of the N_1P_1 component contribute substantially to the μVRMS asymmetries. For the group as a whole in all cases the asymmetries showed greater amplitude in the right hemisphere.

These findings support the results of behavioral research that the right hemisphere in right-handed individuals is specialized for some aspect of visuospatial processing (Kimura, 1966; Milner, 1971). In this vein it is interesting to note, in contrast to Lewis and Rimland (1980) that no asymmetries were found for the grey stimulus supporting the contention that the asymmetry may be related to some form of

6

specialization for visuospatial stimuli.

The results also suggest that the evoked potential may serve as an index of this specialization. This possibility is supported when one examines the data from the two groups divided on the basis of supervisors' ratings. These data in particular suggest that the magnitude of the interhemispheric asymmetry elicited by complex visual stimuli is related to performance on tasks that require competence in the processing of visual spatial information.

A final point related to this possibility concerns the data separated on the basis of the presence or absence of left-handed relatives. The literature dealing with the results of brain damage in this type of person and the behavioral literature studying perceptual abilities in normals suggests that individuals with left-handed relatives are less likely to be highly lateralized on perceptual tasks and in addition their performance levels may be lower than those of right-handed persons without a family history of sinistrality (Carter-Saltzman, 1979; Hicks, 1975; Hines & Satz, 1974).

The data in the current study show that the interhemispheric asymmetries of individuals with left-handed relatives are smaller for the N_1P_1 measure on the texture pattern than found in individuals without left-handed relatives. Davidson, Schwartz, Pugash, and Bromfield (1976) similarly reported EEG asymmetries in right-handed subjects, but only in those subjects without left-handed

relatives. The question of the level of competence on sonar tasks of right-handed persons with left-handed relatives is currently being addressed in a related study.

In summary, these findings suggest that interhemispheric asymmetries in evoked potential amplitude are related to differences in performance on complex visuospatial tasks. These amplitudes could therefore be used to predict performance of sonar operators and also could be used either in the initial selection of sonar operators or as a monitor of the effectiveness of training.

ACKNOWLEDGMENT

REFERENCES

Begleiter, H. (Ed.) Evoked brain potentials and behavior. Plenum Press, New York, 1979.

Bigum, H. B., R. E. Dustman, and E. C. Beck. Visual and somato-sensory evoked responses from mongoloid and normal children. Electroencephalogr. Clin. Neurophysiol. 28: 576-585, 1970.

Briggs, G. G. and R. D. Nebes. Patterns of hand preference in a student population. Cortex 11: 230-238, 1975.

Callaway, E. Brain electrical potentials and individual psychological differences. Grune & Stratton, New York, 1975.

Callaway, E., R. T. Jones and R. S. Layne. Evoked responses and segmental set of schizophrenia. Arch. Gen. Psychiatry 12: 83-89, 1965.

Carter-Saltzman, L. Patterns of cognitive functioning in relation to handedness and sex-related differences. Pp 97-118 in M. A. Wittig and A. C. Petersen (Eds.) Sex-related differences in cognitive functioning. Academic Press, New York, 1979.

Connors, C. K. Cortical visual evoked responses in children with learning disorders. Psychophysiol. 7: 418-428, 1970.

Davidson, R. J., G. E. Schwartz, E. Pugash and E. Bromfield. Sex differences in patterns of EEG asymmetry. Biol. Psychol. 4: 119-138, 1976.

Hicks, R. E. Intrahemispheric response competition between vocal and unimanual performance in normal adult males. J. Comp. Physiol.Psychol. 89: 50-60,1975.

Hines, D. and P. Satz. Cross-modal asymmetries in perception related to asymmetry in cerebral function. Neuropsychologia 12: 239-247, 1974.

Inderbitzen, L. B., M. Buchsbaum, and J. Silverman. EEG-averaged evoked response and perceptual variability in schizophrenics. Arch. Gen. Psychiatry 23: 438-444, 1970.

Jackson, S. A. and C. Barber. The effect of temporal stimulus parameters upon the VER. In C. Barber (Ed.) Evoked potentials, University Park Press, Baltimore, 1980.

Jasper, H. The ten twenty electrode system of the international federation. Electroencephalogr. Clin. Neurophysiol. 10: 371-375, 1958.

Kimura, D. Dual functional asymmetry of the brain in visual perception. Neuropsychologia 4: 275-285, 1966.

Kinney, J. A. S. Transient visually evoked potential. J. Opt. Soc. Am. 76: 1465-1474, 1977.

Ledlow, A., J. M. Swanson and M. Kinsbourne. Reaction times and evoked potentials as indicators of hemispheric differences for laterally presented name and physical matches. J. Exp. Psychol: Hum. Percept.Perform. 4: 440-454, 1978.

Lewis, E. G., R. E. Dustman and F. C. Beck. The effects of alcohol on visual and somato-sensory evoked responses. Electroencephalogr. Clin. Neurophysiol. 28: 202-205, 1970.

Lewis, G. W. and B. Rimland. Psychobiological measures as predictors of sonar operator performance. Navy Personnel Research and Development Center, San Diego, CA TR80-26, 1980.

Lewis, G. W., B. Rimland, and E. Callaway. Psychobiological predictors of success in a Navy remedial reading program. Navy

Personnel Research and Development Center, San Diego, CA. TR77-13, 1976.

Lewis, G. W., B. Rimland and E. Callaway. Personal communication, 1979.

Malerstein, A. J. and E. Callaway. Two-tone average evoked response in Korsakoff patients. J. Psychiatry Res. 6: 253-260, 1969.

Matsumiya, Y. The psychological significance of stimuli and cerebral evoked response asymmetry. Pp 138-161 in D. I. Mostofski (Ed.) Behavior control and modification of physiological activity. Prentice-Hall,Inc. Englewood Cliffs, NJ, 1976.

Milner, B. Interhemispheric differences in the localization of psychological processes in man. Br. Med. Bull. 27: 272-277, 1971.

Preston, M. S. The use of evoked response procedures in studies of reading disability. Pp 247-268 in H. Begleiter (Ed.) Evoked brain potentials and behavior. Plenum Press, New York, 1979.

Preston, M. S., J. T. Guthrie, and B. Childs. Visual evoked responses (VERs) in normal and disabled readers. Psychophysiol. 11: 452-457, 1974.

Rhodes, L. E., R. E. Dustman, and E. C. Beck. The visual evoked response: a comparison of bright and dull children. Electro-encephalogr. Clin. Neurophysiol. 27: 364-372, 1969.

Rugg, M. D. and J. Beaumont. Late positive component correlations of verbal and visuospatial processing. Biol. Psychol. 9: 1-11,1979.

Santoro, T. and D. Fender. Rules for the perception of connectivity in random dot patterns. Vision Res. 16: 973-981, 1976.

Vella, E.J., S. R. Butler, and A. Glass. Electrical correlate of right hemisphere function. Nature New Biol. 236: 125-126, 1972.

Table I. Mean microvolt root mean square values for each stimulus type and each brain side.

	Stripe		Grey		Texture	
	O_1	O_2	O_1	O_2	O_1	O_2
$\bar{X}$ µVRMS	4.59	4.79*	4.32	4.40	3.75	4.03**
S.D.	1.54	1.77	1.47	1.53	1.41	1.73

* $\underline{p} < .05$
** $\underline{p} < .005$

Table II. Mean latency (milliseconds) for the two major components of the visual evoked response for each stimulus type and each brain side.

Component	Brain Side		Stimulus Type		
	O_1	O_2	Stripe	Grey	Texture
N_1	74.71	74.12	71.10	77.19	74.93
P_1	141.96	142.56	130.06	147.58	139.12

10
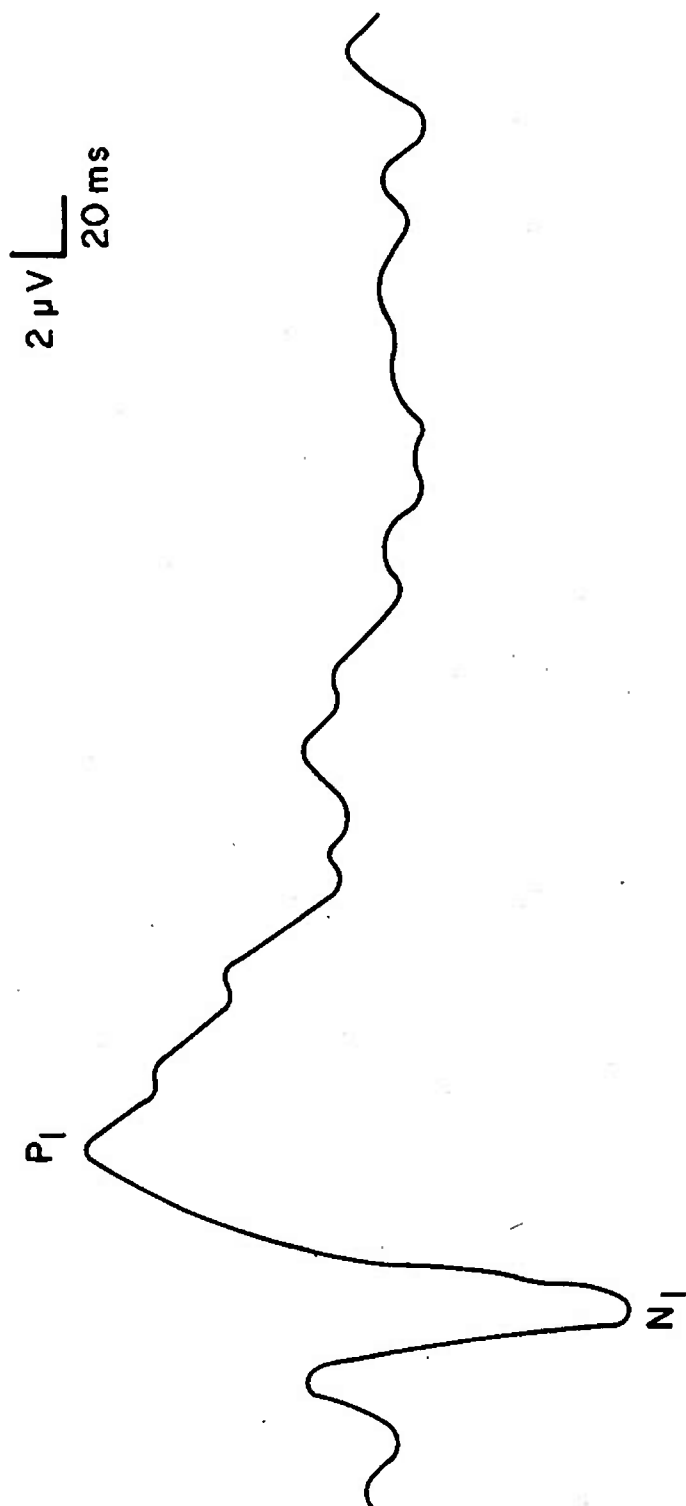
Fig. 1. An example of a visual evoked potential obtained to the texture stimulus. The locations of N_1 and P_1 are marked.
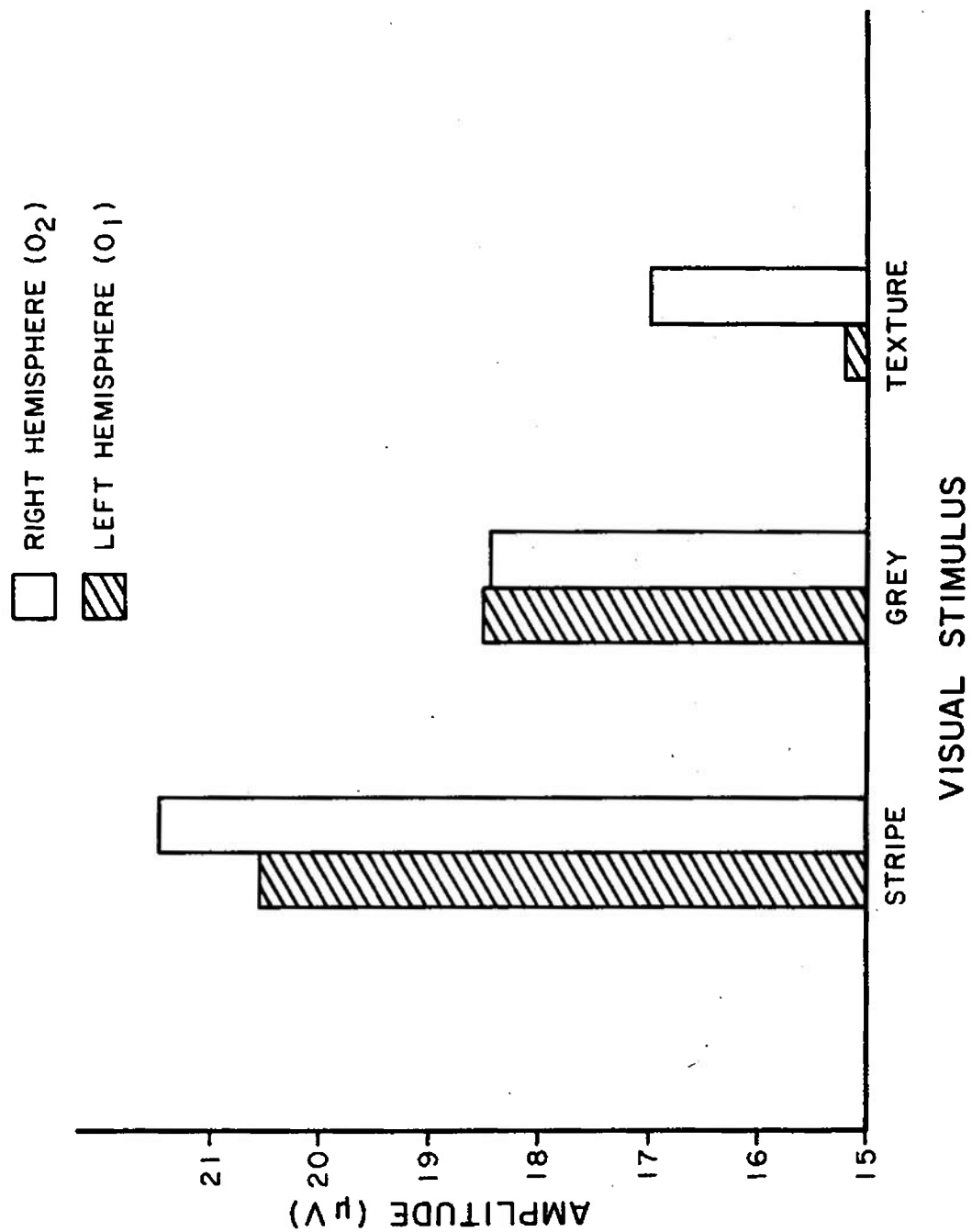
Fig. 2. Mean amplitude of the peak to trough measure from N_1 to P_1 for each brain side and each visual stimulus.
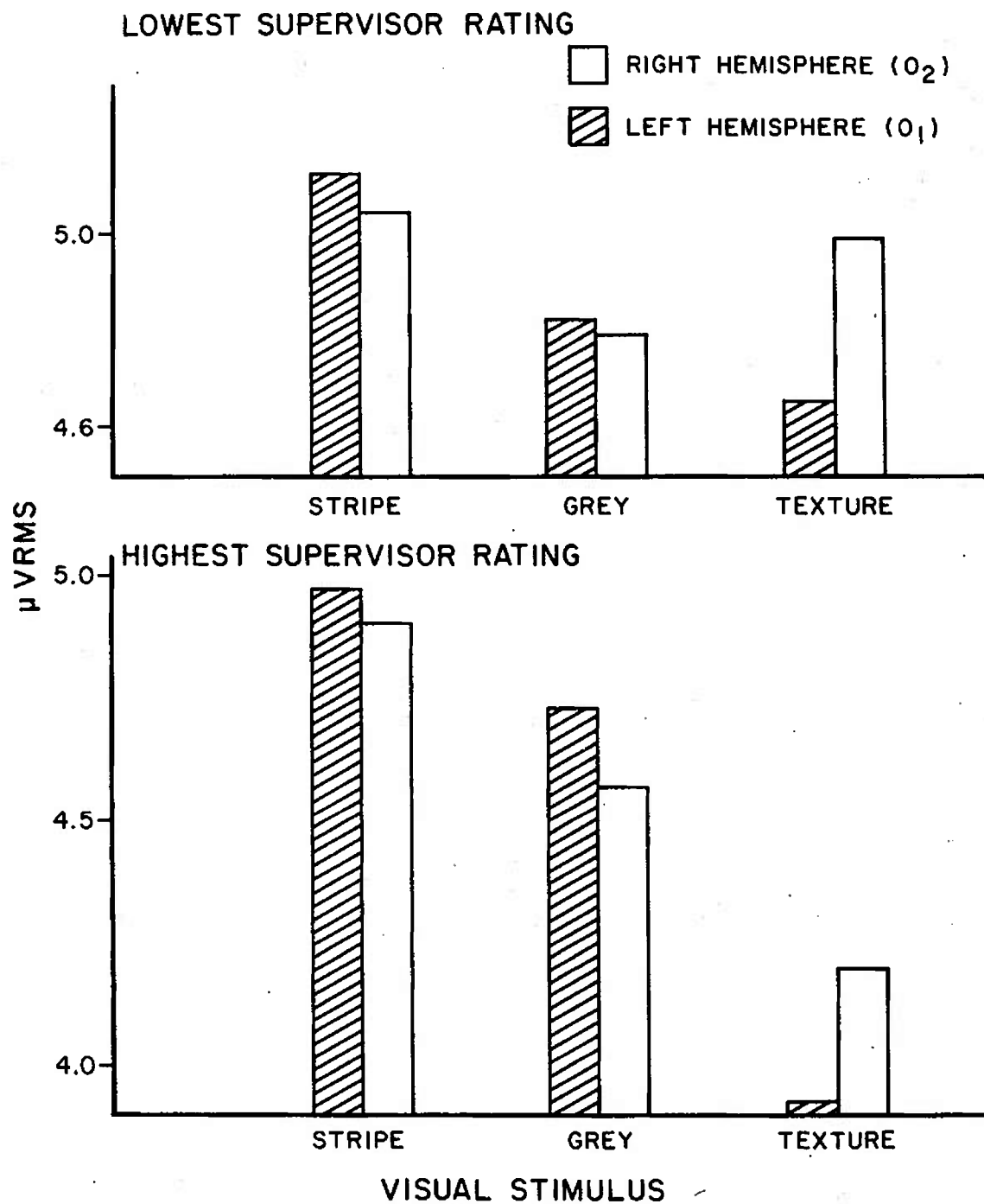
Fig. 3. Mean amplitude for the μVRMS measure for the two groups based on supervisor rating. The top panel shows the mean amplitudes for the group with the lowest ratings; the bottom panel shows the group with the highest ratings.
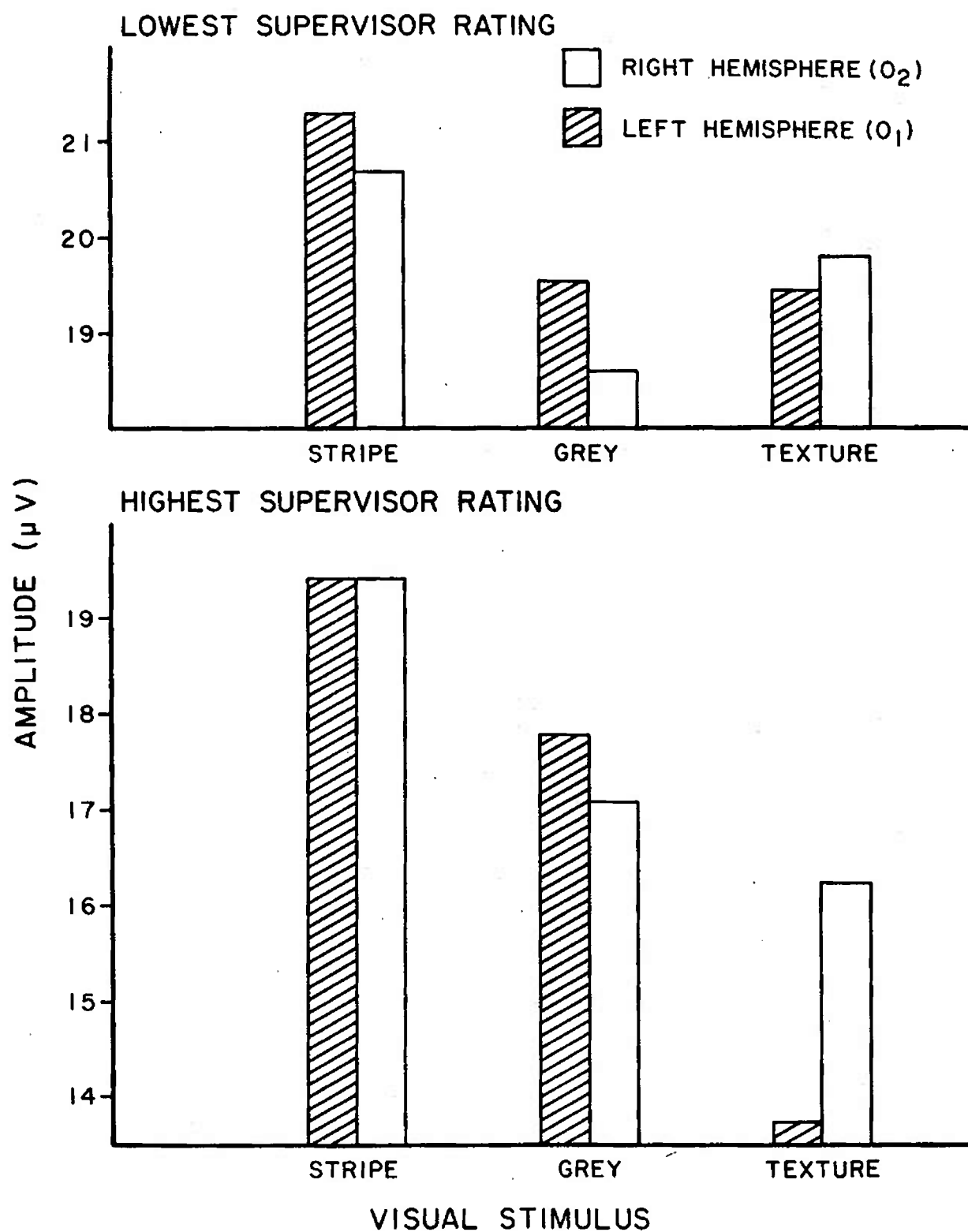
Fig. 4. Mean amplitude for the N_1P_1 peak to trough measure for the two groups based on supervisor rating. The top panel shows the amplitudes for the group with the lowest ratings; the bottom panel shows the group with the highest ratings.
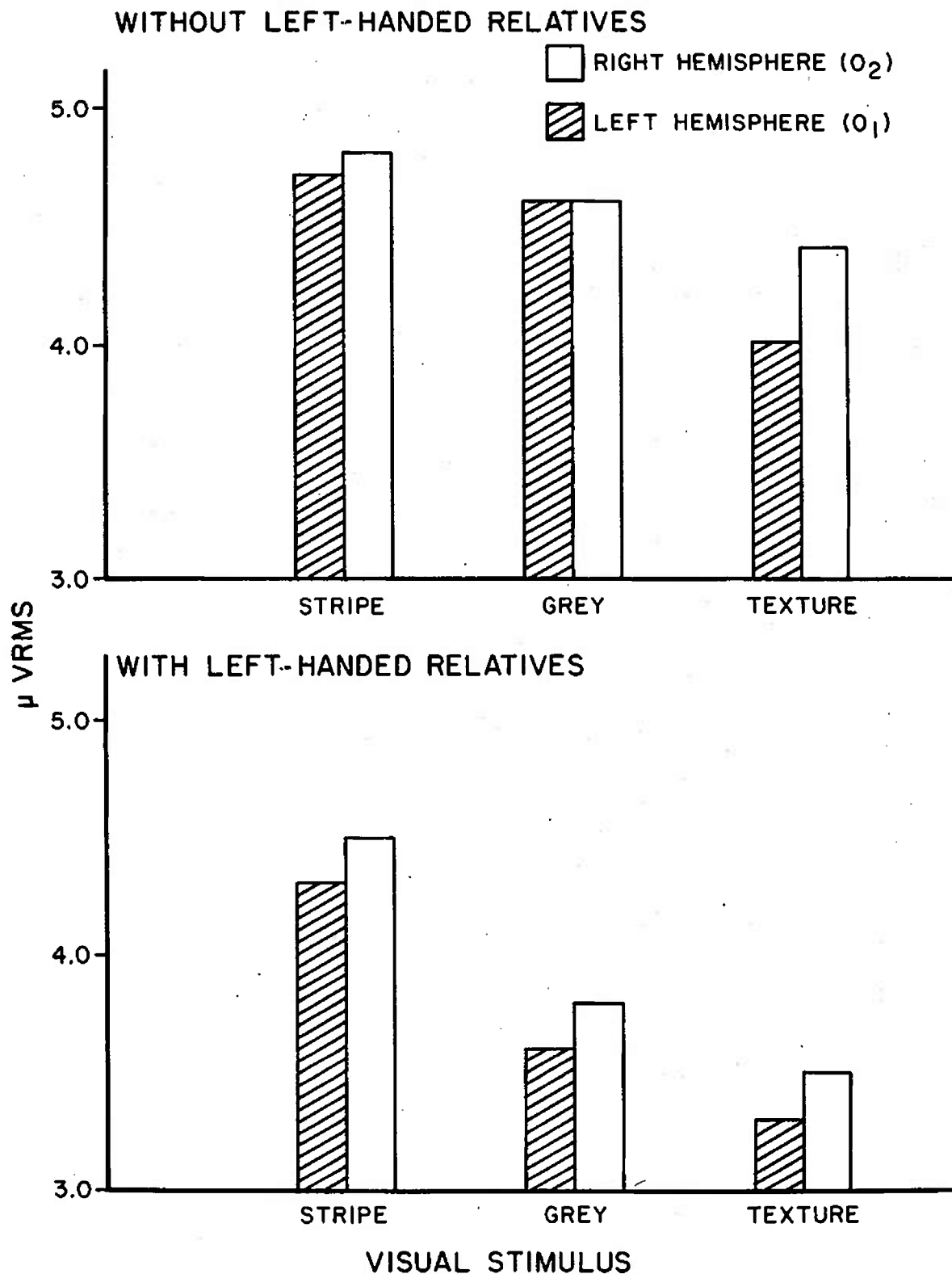
Fig. 5. Mean amplitude of the μVRMS for the two groups comprised of subjects without left-handed relatives (top panel) and subjects with left-handed relatives (bottom panel).
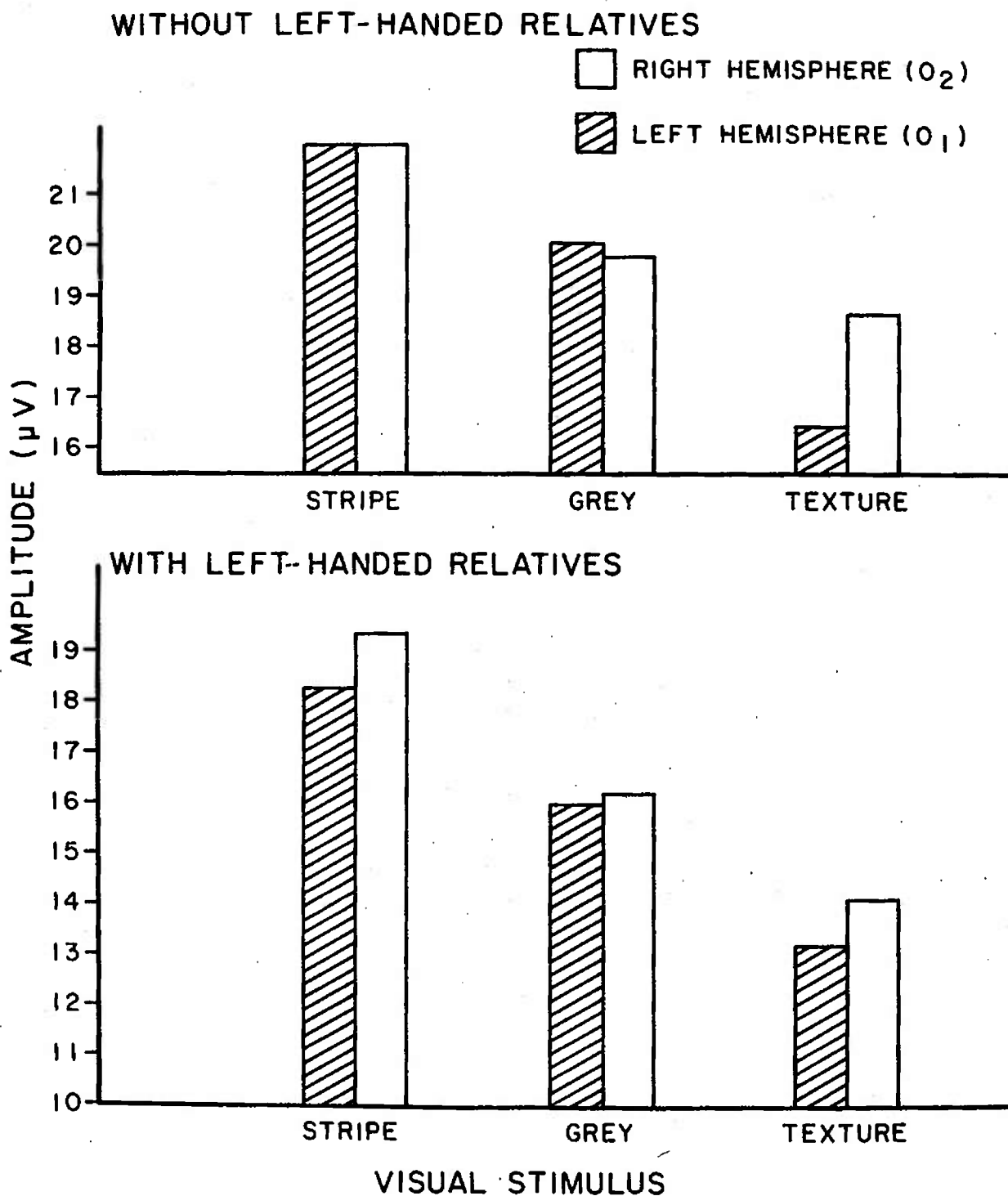
Fig. 6. Mean amplitude of the N_1P_1 peak to trough measure for the two groups comprised of subjects without left-handed relatives (top panel) and subjects with left-handed relatives (bottom panel).

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NSMRL Rep. No. 957	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) THE RELATIONSHIP OF VISUAL EVOKED POTENTIAL ASYMMETRIES TO THE PERFORMANCE OF SONAR OPERATORS		5. TYPE OF REPORT & PERIOD COVERED Interim report
		6. PERFORMING ORG. REPORT NUMBER NSMRL Report No. 957
7. AUTHOR(s) C. L. Schlichting and S. W. Kindness		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Submarine Medical Research Laboratory Box 900, Naval Submarine Base Groton, Connecticut 06349		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 61153N MR041.01.03-0155
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Submarine Medical Research Laboratory Box 900, Naval Submarine Base Groton, Connecticut 06349		12. REPORT DATE 11 Aug 1981
		13. NUMBER OF PAGES 16
14. MONITORING AGENCY NAME & ADDRESS(If different from Controlling Office) Naval Medical Research and Development Command National Naval Medical Center Bethesda, Maryland 20014		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, If different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side If necessary and identify by block number)

Visual evoked potential; sonar; performance

20. ABSTRACT (Continue on reverse side If necessary and identify by block number)

Interhemispheric differences in visual evoked potential amplitude were measured in 32 right handed sonar operators. Each operator was also rated by his supervisor as to his performance using visual sonar displays. Significant interhemispheric asymmetries were found in the group as a whole and in the better performers. Poorer performers did not show asymmetries. These results suggest that the magnitude and direction of interhemispheric asymmetries in evoked potential amplitude can be used in

#20 continued:

the prediction of performance as sonar operators. These measures could also be used to test the effect of training and watch standing schedules.